

WHAT IS CLAIMED IS:

1. An optical imaging system comprising:

5 a rod lens array comprising a plurality of rod lenses having a refractive index distribution in a radial direction that are arranged in two rows with their optical axes in parallel, and

a manuscript plane and an image plane that are located on opposite sides of the rod lens array,

10 wherein the refractive index distribution of the rod lenses is expressed by

$$Eq. 1 \quad n(r)^2 = n_0^2 \cdot \{1 - (g \cdot r)^2 + h_4 \cdot (g \cdot r)^4 + h_6 \cdot (g \cdot r)^6 + h_8 \cdot (g \cdot r)^8\}$$

15 where r is a radial distance from an optical axis of the rod lenses, n_0 is a refractive index on the optical axis of the rod lenses, and g , h_4 , h_6 and h_8 are refractive index distribution coefficients,

the refractive index distribution coefficients h_4 , h_6 and h_8 are on a spheroid in a Cartesian coordinate system with h_4 being x-axis, h_6 being y-axis and h_8 being z-axis, and

20 the spheroid is defined by a vector X^* that is expressed by

$$Eq. 2 \quad X^* = (x, y, z) = O^* + k_A A^* + k_B B^* + k_C C^*$$

25 where O^* is a vector from an origin of the Cartesian coordinate system to a center of the spheroid, A^* , B^* and C^* are vectors in the directions of a major axis, a mean axis and a minor axis of the spheroid, respectively, and k_A , k_B and k_C satisfy $k_A^2 + k_B^2 + k_C^2 \leq 1$.

30 2. The optical imaging system according to claim 1, wherein k_A , k_B and k_C satisfy

$$Eq. 3 \quad k_A^2 + k_B^2 + k_C^2 \leq 0.7.$$

35 3. The optical imaging system according to claim 1, wherein the refractive index n_0 on the optical axis of the rod lenses is in a range of $1.4 \leq n_0 \leq 1.8$.

4. The optical imaging system according to claim 1, wherein a product $g \cdot r_0$ of the refractive index distribution coefficient g and a radius r_0 of a portion of each rod lens functioning as a lens is in a range of $0.04 \leq g \cdot r_0 \leq 0.27$.

5. The optical imaging system according to claim 1, wherein the refractive index distribution of the rod lenses is expressed by

$$Eq. 4 \quad n(r)^2 = n_0^2 \cdot \{1 - (g \cdot r)^2 + f(r)\}$$

where $f(r)$ is a function of r , and the $f(r)$ satisfies

$$Eq. 5 \quad h_{4A} \cdot (g \cdot r)^4 + h_{6A} \cdot (g \cdot r)^6 + h_{8A} \cdot (g \cdot r)^8 \leq f(r) \leq h_{4B} \cdot (g \cdot r)^4 + h_{6B} \cdot (g \cdot r)^6 + h_{8B} \cdot (g \cdot r)^8$$

for r in a range of $0 \leq r \leq r_0$ (r_0 : a radius of a portion of each rod lens functioning as a lens) with respect to two groups of refractive index distribution coefficients ($n_0, g, h_{4A}, h_{6A}, h_{8A}$) and ($n_0, g, h_{4B}, h_{6B}, h_{8B}$) that are in the ranges determined by Equation 2.

6. The optical imaging system according to claim 1, wherein a radius r_0 of a portion of each rod lens functioning as a lens is in a range of $0.05 \text{ mm} \leq r_0 \leq 0.60 \text{ mm}$.

7. The optical imaging system according to claim 1, wherein r_0/R is in a range of $0.5 \leq r_0/R \leq 1.0$, where r_0 is a radius of a portion of each rod lens functioning as a lens and $2R$ is a distance between the optical axes of two neighboring rod lenses.

8. The optical imaging system according to claim 1, wherein Z_0/P is in a range of $0.5 \leq Z_0/P \leq 1.0$, where Z_0 is a length of the rod lenses and $P = 2\pi/g$ is a one-pitch length of the rod lenses.

9. The optical imaging system according to claim 1, wherein an overlapping degree m is in a range of $0.9 \leq m \leq 5.0$, and the overlapping degree m is given by $m = X_0/2r_0$, where r_0 is a radius of a portion of each rod lens functioning as a lens and X_0 is an image radius that the rod lens

projects onto the image plane.

10. The optical imaging system according to claim 1, wherein a parallel plane transparent substrate is arranged so that the manuscript plane is
5 located at a front focal position of the rod lens array.

11. The optical imaging system according to claim 10, wherein the
parallel plane transparent substrate is in contact with a lens surface of the
rod lens array.
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